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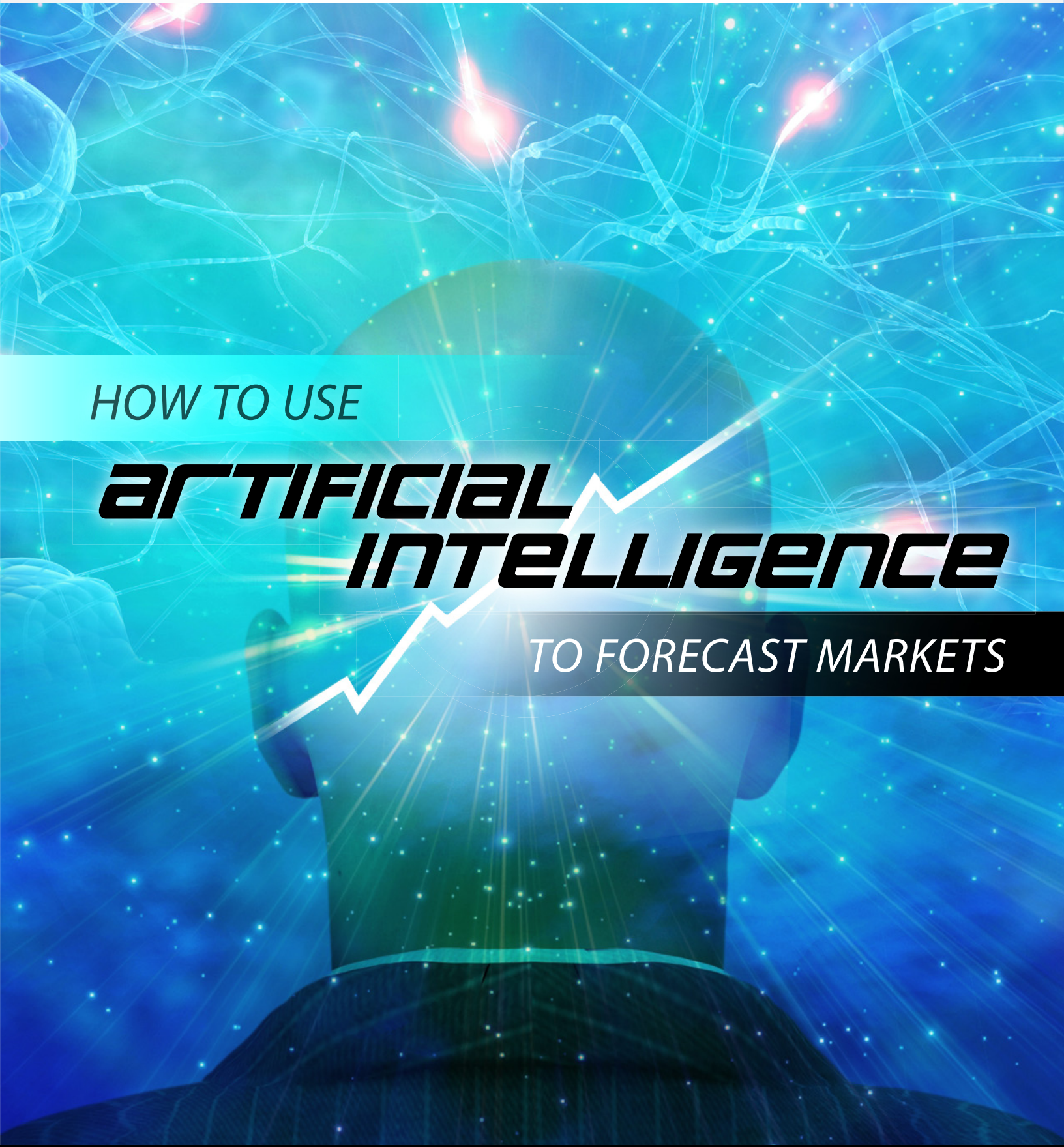


HOW TO USE ARTIFICIAL INTELLIGENCE TO FORECAST MARKETS

TRADERPLANET SPECIAL REPORT

VISIT…

USING NEURAL NETWORKS TO ANALYZE MARKETS

Louis Mendelsohn is a pioneer in the development of trading software relying on neural networks processing data from intermarket analysis. This powerful combination transformed the predictive capabilities of technical analysis from a single-market perspective relying on human interpretation of patterns to forecast to a computer-based, pattern-recognition forecast deriving data from 25 inter-related markets.

In the late 1980s, Mendelsohn realized that our perspective on markets analysis and trading would change because the coming revolution in computer technology would transform both information processing and information transmission. He foresaw the evolution in technology would connect global economies and global markets in such a way that market analysis could no longer ignore intermarket relationships, and, equally important, that computer software would become more reliable in pattern recognition, the heart of technical analysis. This "quantification" of related markets combined with state-of-the-art neural networks produced ***VantagePoint Intermarket Analysis Software***, a leader in near-term market forecasting with up to an 86% accuracy rate.

> One of the problems with neural networks is that they are complex, they tend to border on curve fitting, and you can spend a lot of effort simply trying to predict whether one market will be higher or lower tomorrow. Then one day, I happened upon Louis Mendelsohn through his web site and was quite impressed with what I saw there ... This internationally acclaimed technical analyst, investment-software developer, and financial author had produced highly accurate, market-analysis software that eliminated for the user the complexities and effort involved in utilizing neural networks for predicting market trends.
>
> ***Dr. Van K. Tharp***

When considering all of the shifting and changing intermarket relationships, traders might wonder how anyone could possibly pick out patterns and relationships from such a huge mass of moving data. The answer is neural networks, and when applied to price, volume, and open interest data on each target market and various related markets, neural networks can forecast trends with amazing accuracy.

Unlike the subjective approach of chart analysis, neural networks provide an objective way to identify and analyze the complex relationships that exist in all related markets. They reveal hidden patterns and correlations in these markets that otherwise cannot be spotted on a chart or through traditional, single-market, lagging indicators.

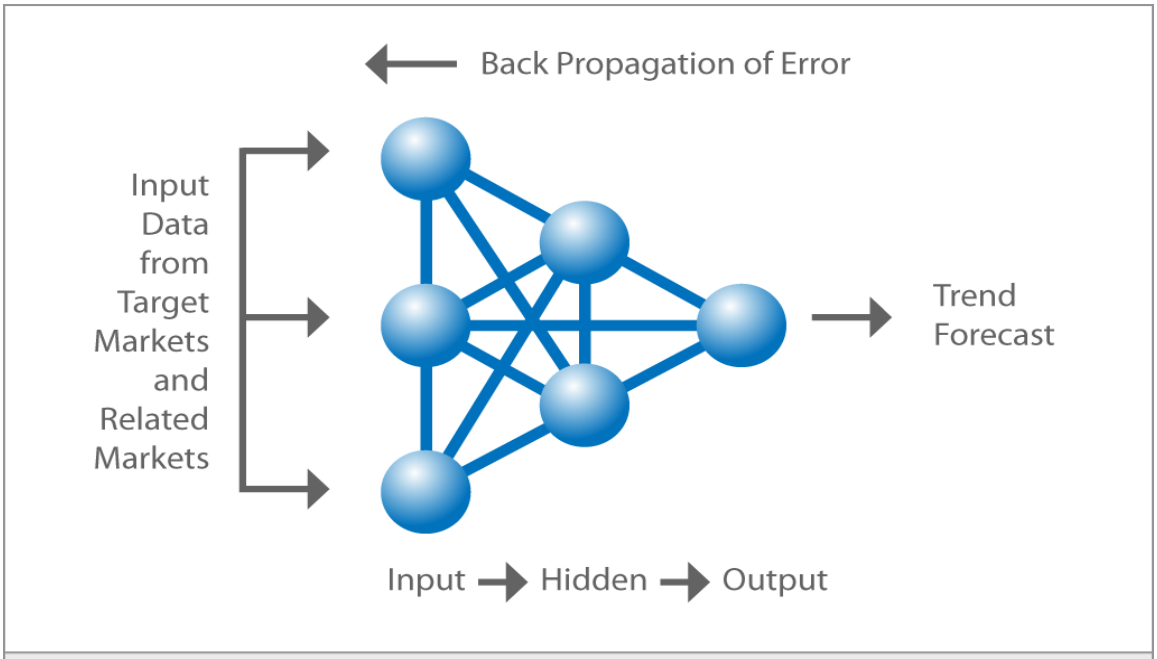
A neural network is not a human brain, but it takes on some brain-like functions as it studies data, "learns" relationships ***within*** and ***between*** markets, recognizes patterns in past data, and uses this information to make forecasts about a market. Essentially, the neural network is a modeling tool processing a variety of data and information in a manner similar to the brain.

Neural networks have a history in corporate decision-making, medical diagnostics, space exploration, weather predication, and many other specialized applications, which means the concept has been tested, modified, and improved over the years. Today, traders don't have to worry about "getting under the hood" with neural networks. Expert software developers have done extensive experimentation to create the best trading model using neural networks. However, for traders to have confidence in a neural-network-trading model, it is worthwhile to have at least some understanding of neural networks and their training process.

INPUT LAYER

Forecasts derived from a neural network are only as good as the data fed into it; thus, a critical first step in neural-network analysis is data input. Collecting, filtering, selecting, and preparing the data for analysis are all important. Neural networks are not limited to single-market data inputs, nor are they limited solely to technical data inputs. The data for the neural-network-trading model goes far beyond just price or technical indicators. It includes volume and open interest for a market, intermarket data from related markets, and fundamental data for the specific market, as well as related markets.

The raw, data-input involved in the neural-network-trading model includes the daily open, high, low, close, volume and open interest for forex and options, plus the daily open, high, low, close, volume and open interest data for 25 inter-related markets.



NEURAL NETWORKS CONTINUOUSLY TRY TO FIND HIDDEN PATTERNS. LIKE THE HUMAN BRAIN, NEURAL NETWORKS "LEARN" BY SIFTING THROUGH DATA OVER AND OVER AGAIN TO FIND PATTERNS.

HIDDEN LAYER

The hidden layer is the learning algorithm used for internal processing. This layer stores the "intelligence" gained during the learning process. A number of learning algorithms in the neural network recode the data-input to capture hidden patterns and relationships in the data, allowing the neural network to form general conclusions from previously learned facts and apply those conclusions to new data-inputs. As this learning continues, the neural network creates an internal mapping of the data-input, discerning the underlying causal relationships that exist within the data. This is what allows the neural network to make highly accurate market forecasts. Utilizing many different learning algorithms to train a neural network minimizes errors associated with the forecasts.

Training a neural network is somewhat like human learning—repetition, repetition, repetition. The neural network learns from repeated exposures to the data-input. The neural network then stores the learned information in the form of a "weight" matrix. Changes in the weights occur as the neural network "learns." Similar to the human learning process, neural networks learn behaviors or patterns from exposure to repeated examples of those behaviors or patterns. This repeated exposure allows neural networks to generalize conclusions about related but previously unseen behaviors or patterns.

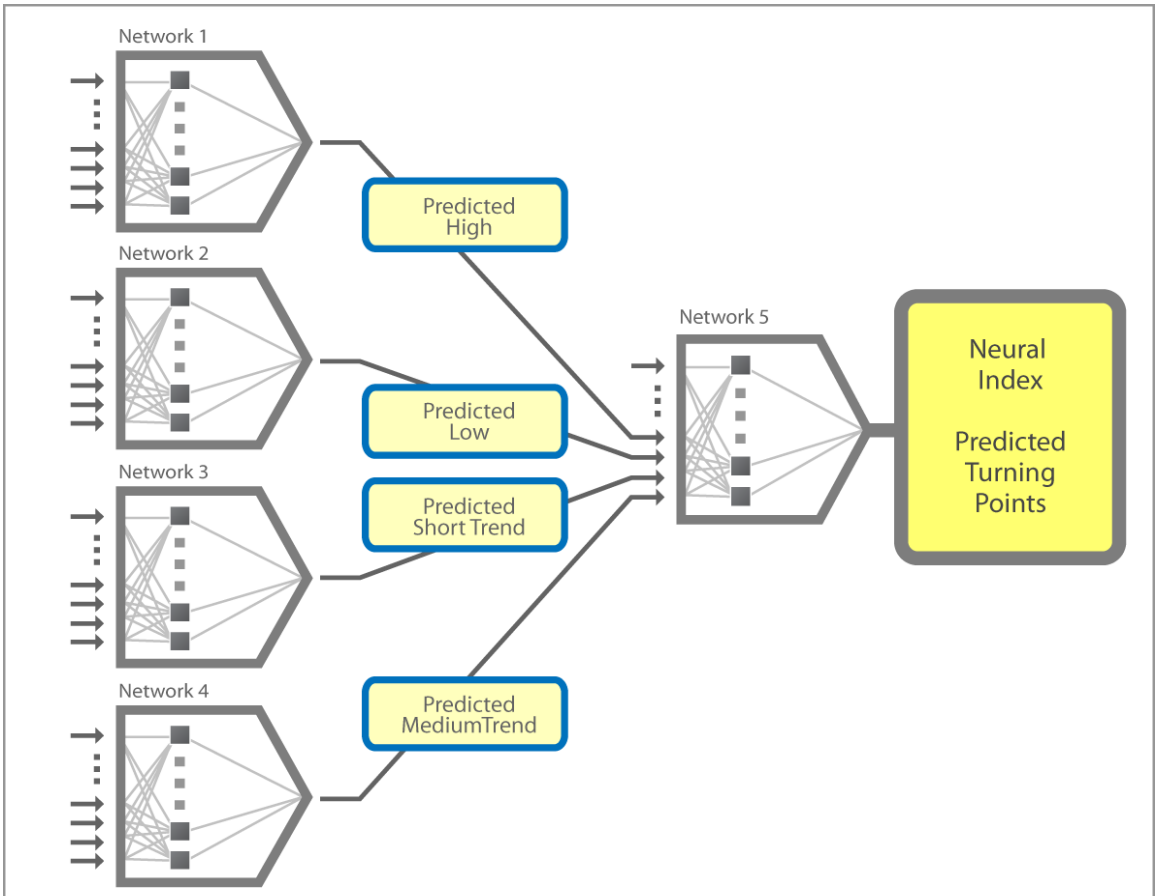
Although a neural-network trading model can accommodate and analyze vast amounts of data, a programmer can "over-train" it, which is analogous to "curve-fitting" or "over-optimization" in testing rules-based, trading strategies. It takes considerable experimentation to determine the optimum number of "neurons" in the hidden layer and the number of hidden layers in a neural network.
If the hidden layer has too few neurons, it cannot map outputs from data-inputs correctly. If a neural network has too many hidden-layer neurons, it memorizes the patterns in the training data, losing the ability to generalize about new data and to discover new underlying patterns and relationships. An over-trained network performs well on the training data, but poorly on out-of-sample test data and subsequently during real-time trading—just like an over-optimized rule-based system.

OUTPUT LAYER

The output layer of the neural network produces the forecasts. During training, the neural network makes its forecasts, detects any errors, and it adjusts the "connection weights" between neurons prior to the next training iteration. An algorithm named the "learning law" alters the connection weights by including the back-propagation method, which minimizes output errors.

Extensive testing then verifies the accuracy of the neural-network forecasts. An independent test file of data, not used during the training process, is the basis of the testing. In the testing mode, the neural network is given these new inputs and uses the representation that it had previously learned to generate its forecasts. This way, the neural network is evaluated under real-time conditions. This is analogous to the "walk-forward" or "out-of-sample" testing of rules-based trading strategies. The developers can then compare performance results from various neural networks and decide which neural network to use in the final application.

The result of all this testing is a trading tool that is highly accurate and simple to use, even by novice traders. Traders do not have to be software developers to apply the forecasting capabilities of neural networks in trading the markets.



MAP OF A SUCCESSFUL NEURAL NETWORK TRADING PROGRAM. VANTAGEPOINT IS AN EXAMPLE OF AN ANALYTICAL SOFTWARE PROGRAM THAT USES MULTIPLE NEURAL NETWORKS TO ANALYZE DATA AND PRODUCE MARKET FORECASTS.

THE PROOF IS IN THE TRADING

Obviously, no neural network, nor any other trading tool, can give you 100% predictive accuracy. Unforeseen events and random price-action continue to produce uncertain markets. The focus is to achieve the most accurate market forecasts as is possible. Neural networks are excellent mathematical tools for finding hidden patterns and relationships in seemingly disparate data and making highly accurate short-term, market forecasts in a consistent, objective, quantitative manner.

Intermarket analysis combined with neural networks creates powerful forecasting tools. Traders utilizing intermarket-based trend forecasts have a broader vantage point on the markets than could otherwise be achieved by focusing solely upon the internal dynamics of one market at a time.

VantagePoint software uses five neural networks, in a two-level hierarchy, to forecast five different indicators for that market.

1. **The first forecasts the next-day high to help set stops for entry and exit points.**
2. **The second forecasts the next-day low to help set stops for entry and exit points.**
3. **The third forecasts a five-day moving average of closes two days into the future to indicate the expected short-term trend direction within the next two days.**
4. **The fourth forecasts a ten-day moving average of closes four days into the future to indicate the expected medium-term trend direction within the next four days.**
5. **The fifth indicates whether a market is expected to change trend direction, making a top or a bottom, within the next two days.**

The first four neural networks at the primary level of the hierarchy make independent market forecasts of the high, low, short- and medium-term trend. These predictions are then input into the fifth network, along with other intermarket data input at the secondary level of the network hierarchy, to predict market turning points.

Once selected, raw data input is pre-processed or massaged using various algebraic and statistical methods of transformation, which helps facilitate "learning" by the neural network. The learning algorithm converts the massaged data to get the most accurate forecasts in the shortest amount of time.

Independent testing has verified the effectiveness of neural networks, and the proof is in real trading. VantagePoint software, which has also been independently tested, forecasts short-term trends with an **up to 86% accuracy rate.**

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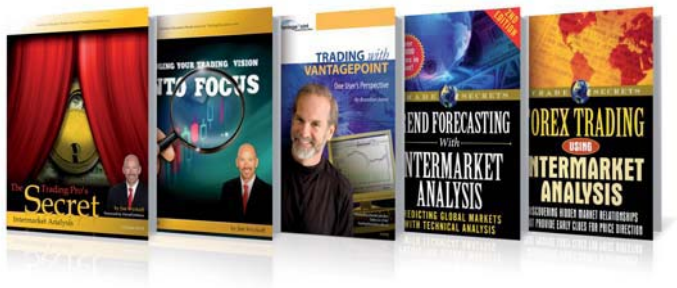

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